CRIMS ISLAND ECOSYSTEM RESTORATION SEDIMENT QUALITY EVALUATION REPORT

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ACRONYMS

EPA	Environmental Protection Agency
USACE	U.S. Army Corps of Engineers
USFWS	U. S. Fish & Wildlife Service
NOAA	National Oceanic & Atmospheric Administration (formerly NMFS)
NMFS	National Marine Fisheries Service
WDOE	Washington Department of Ecology
ODEQ	Oregon Department of Environmental Quality
WDNR	Washington Department of Natural Resources
DMEF	Dredge Material Evaluation Framework
CRM	Columbia River Mile
CRCIP	Columbia River Channel Improvement Project (formerly, Columbia River Channel Deepening)
CFR	Code of Federal Regulations
QA/QC	Quality Assurance/Quality Control
MDL	Method Detection Limit
CoC	Contaminate of concern
TOC	Total Organic Carbon
PAH	Polynuclear Aromatic Hydrocarbon
PCB	Polychlorinated Biphenyl
MDL	Method Detection Limit
PQL	Practical Quantitation Limit
MRL	Method Reporting Limit
TVS	Total Volatile Solids
ND	non-detect
As	Arsenic
Cd	Cadmium
Ni	Nickel
Cu	Copper
Sb	Thallium
Cr	Chromium
Pb	Lead
Hg	Mercury
Ni	Nickel
Ag	Silver
Zn	Zinc

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**CRIMS ISLAND ECOSYSTEM RESTORATION
SEDIMENT QUALITY EVALUATION REPORT**

ABSTRACT

Crims Island is bordered on the southeast by Bradbury Slough, a 3 mile-long side channel to the Columbia River, branching off the mainstem at CRM 57 and returning to the Columbia River at CRM 54 (See Figure 1).

A total of five (5) sediment samples were collected from the project site July 15, 2003 (see figure 2). All samples were submitted for physical analyses, including total volatile solids. Samples were, also, analyzed for metals (9 inorganic), total organic carbon, pesticides and polychlorinated biphenyls, phenols, phthalates, miscellaneous extractables and polynuclear aromatic hydrocarbon.

Evaluation of the sediment was conducted following procedures set forth in the U.S. Army Corps of Engineers' "Upland" Testing Manual and the "Inland" Testing Manual, developed jointly by the Corps and the U.S. Environmental Protection Agency, to assess dredged material. Guidelines used are those developed to implement the Clean Water Act. These guidelines and associated screening levels are those adopted for use in the Dredge Material Evaluation Framework for the Lower Columbia River Management Area (DMEF), November 1998 (Signed by USACE, EPA, WDOE, ODEQ and WDNR).

Three (3) samples were classified as "silty sand" and two (2) samples as "sandy silt." Mean grain size for all the samples is 0.05 mm, with 0.05% gravel, 40.67% sand (57.78%-32.38% range), 59.27% silt/clay (75.33%-42.22% range) and 4.60% volatile solids (2.74%-8.78% range).

The chemical analyses indicated low levels of metals, low levels of several phenol and phthalate compounds, and very low levels of PAHs. Only one chemical-of-concern, benzyl alcohol, exceeded DMEF screening guidelines. The benzyl alcohol level in CRIM-SG-02 sample was at 68.9 ug/kg exceeding the 57 ug/kg screening guideline. Sixty percent of the benzyl alcohol produced is used in the textile industry as a dye assistant. Other uses are as lacquer solvent, plasticizer, photographic developer, ballpoint pen inks and as a preservative in medication, as well as, many other uses. It, also, enters the environment from the exhaust of motor vehicles and effluent from Kraft mills. There are natural sources of benzyl alcohol in the environment, as well, it is contained in the oils of several plants; hyacinth and jasmine are two such plants.

When benzyl alcohol is released to the environment it reacts in different ways depending on the media. In dry soil, it is expected to display high mobility and readily leach through soil and volatilize into the air, however, this is not expected to be a significant process in moist soils. In water, benzyl alcohol is expected to undergo microbial degradation under aerobic and anaerobic conditions.

While the level of benzyl alcohol found in sample CRIM-SG-02 does exceed the DMEF screening level, it was detected in only one sample, which possibly picked up an isolated piece of debris containing benzyl alcohol.

It is possible to manage the material represented by CRIM-SG-02, without further characterization, by avoiding disturbance of the area or by excavating and placing the material in upland, without potential exposure to the water column.

If the material, in question, is to be further characterized, to verify the presence and extent of potential contamination of benzyl alcohol. The first phase in additional characterization would likely be to take five (5) additional samples in the area and submit them for benzyl alcohol analyses. If it is determined that this more intense characterization reveals benzyl alcohol is present above the DMEF screening level, then the sediment could be submitted for DMEF Tier III, bioassay analyses.

With the exception of the sediment represented by CRIM-SG-02, all other sediment represented by this sampling event are determined to be suitable for unconfined, in-water or be exposed to water after excavation, without further characterization.

INTRODUCTION

This report characterizes the sediment and soil proposed for dredging and excavation within the Crims Island project area. The sampling and analysis objectives are stated in the Sampling and Analysis Plan (SAP July 2003), and are also listed below. This report will outline the procedures used to accomplish these objectives and include any changes made to the objectives due to field conditions.

Sampling and Analysis Objectives

- To characterize sediments in accordance with the regional dredge material testing manual protocols, the Dredge Material Evaluation Framework for the Lower Columbia River Management Area (DMEF), as well as, the Evaluation of Dredged Material Proposed for Disposal at Island, Nearshore, or upland Confined Disposal Facilities – Testing manual (Upland Testing Manual).

- Collect, handle and analyze representative sediment, of the area to be characterized inwater and upland sites, in accordance with protocols and Quality Assurance/Quality Control (QA/QC) requirements.

- Analyze for full suite of Tier II a & b level DMEF – Table 8.1, Physical, Metals, TOC, Pest/PCBs and Semi-volatiles.

- Characterize sediments to be dredged for evaluation of environmental impact.

- Conduct physical and chemical characterization only for this sediment evaluation, unless further characterization is desired under the Tier III DMEF bioassay protocol.

PREVIOUS STUDIES

In 1997, as part of the Columbia River Channel Improvement Project (CRCIP), 3 samples were collected in the Columbia River Federal Navigational Channel adjacent to Crims Island. Physical analyses were conducted on all 3 samples, with chemical analyses conducted on 1 of the 3 samples. The mean grain size, for all 3 samples was 0.48 mm, with 99.5% sand and 0.3% fines. Chemical data for the sample analyzed indicated no metals, pesticides, PCBs, PAHs, phthalates or phenols above the screening levels of the DMEF.

In 1999 and 2000 EPA, in their EMAP program, collected three (3) sediment samples in the vicinity of Crims Island and Bradbury Slough. Chemical analyses indicated no compounds analyzed exceed the DMEF guidelines.

CURRENT SAMPLING EVENT/PROJECT DISCUSSION

A total of five (5) sediment samples were collected from the project site July 15, 2003. All samples were submitted for physical analyses, including total volatile solids. Chemical analyses were, also, run for metals (9 inorganic), total organic carbon, pesticides and polychlorinated biphenyls, phenols, phthalates, miscellaneous extractables and polynuclear aromatic hydrocarbon.

The sampling event was designed to address each of the following construction elements and their potential for contributing contamination to the water column and habitat developed through the construction effort and final design implementation (see figure 2).

Project Construction Elements:

- **Restoration of Tidal Marsh Habitat:** Portions of the upstream end of Crims Island would be excavated and sloped to provide proper elevations for intertidal marsh and mudflat development. This action would remove existing reed canary grass and replace it with intertidal mudflat and marsh habitat. Sinuous shallow tidal channels would be constructed through the restored intertidal mudflat and marsh to mimic naturally occurring channels. These channels would also improve tidal circulation, allow for greater ingress and egress of juvenile salmonids, and increase detrital export. These channels would connect to an existing sub-tidal channel. Invertebrate production would be increased and made more available to rearing fish that could better access the tidal marsh area post-construction versus the present condition. Sample CRIM-SG-03 was collected in this area.

- **Channel Construction:** One shallow subtidal channel would be excavated through the upstream end of Crims Island from the Columbia River to connect to the existing northern side channel and the tidal marsh restoration site at the upstream end of Crims Island. This element of the restoration would provide for through flow of Columbia River waters and improve juvenile salmonid access and egress to the tidal marsh restoration site and the northern side-channel. A second channel may be constructed into the tidal marsh restoration element from a downstream location along the northern side channel. These shallow channels would improve water flow and circulation through the restored tidal marsh habitat by providing an upstream entrance and additional downstream entrance/exit to the tidal marsh restoration site. This would improve access to the site for juvenile salmonids and increase the export of detritus to Bradley Slough and the mainstem Columbia River. The constructed channel banks would have 1 vertical: 6 horizontal sideslopes to prevent stranding of fish. Samples CRIM-SG-01 and CRIM-SG-02 were collected in this area.

- **T-Channel:** The present inlet channel (T-Channel) banks would be sloped and allowed to naturally revegetate. The existing channel is a remnant drainage ditch with steep sided banks that are vegetated with reed canary grass and blackberries. The banks would be sloped to promote natural revegetation by native tree species and tidal marsh plants. One sample was collected within the channel, CRIM-P-05, and one sample, CRIM-SG-04, was collected in the area where the enhanced tidal channel would be extended.

- **Plug Removal:** A plug that presently blocks a former tidal channel would be removed to restore tidal flow to interior marshes and forested swamp located in the downstream portion of Crims Island. The action would also allow greater ingress and egress of juvenile salmonids and increase detrital export from these marshes. This feature of the plan was considered not to have a significant environmental effect and was not sampled.

- **Riparian Forest Restoration:** Excavated soils from the tidal marsh and channel construction elements would be placed on adjacent pasturelands and subsequently be restored to riparian forest. Pasturelands not used for disposal of excavated material would be tilled and developed as riparian forest habitat, too. This feature of the plan was considered upland excavation and, as such, would not have a significant effect on the inwater habitat and was not sampled.

Table 1. Sample Location Coordinates
(NAD 83, Oregon State Plane North)

CRIM-SG-01	46º 10’ 31.0” 123º 07’ 31.3”	CRIM-SG-02	45º 10’ 31.7” 123º 07’ 50.9”
CRIM-SG-03	45º 10’ 25.6” 123º 07’ 55.7”	CRIM-SG-04	45º 10’ 27.4” 123º 08’ 26.0”
CRIM-SG-05	45º 10’ 21.8” 123º 08’ 30.4”		

RESULTS

Physical and Volatile Solids (ASTM methods).
Five (5) samples were submitted for physical and volatile solids analyses, with data presented in Table 2. Three (3) samples were classified as “silty sand” and two (2) samples as “sandy silt.” Mean grain size for all the samples is 0.05 mm, with 0.05% gravel, 40.67% sand (57.78%-32.38% range), 59.27% silt/clay (75.33%-42.22% range) and 4.60% volatile solids (2.74%-8.78% range).

Metals (EPA method SW846-6020/7471), Total Organic Carbon (TOC) (EPA method SW846-9060).
Five (5) samples were submitted for testing, with data presented in Table 3. The TOC ranged from 5470 to 36,600 mg/kg in the samples, with a mean value of 14,044 mg/kg. None of the metals tested, approached their respective DMEF screening levels.

Pesticides/PCBs (EPA method SW846-8081A/8082), Phenols, Phthalates and Miscellaneous Extractables (EPA method SW846-8270C).
Five (5) samples were submitted for testing, with data presented in Table 4. One pesticide, heptachlor, was detected in one sample, CRIM-SG-02 at 7.37ug/kg, but at a level below the DMEF screening level of 10.0 ug/kg. No PCB aroclors were detected at the SL for total PCBs of 130 ug/kg. One (1) phenol, two (2) phthalates and two (2) miscellaneous extractable compounds were detected; benzyl alcohol at 68.9 ug/kg in sample CRIM-SG-02 exceeded the DMEF screening level of 57 ug/kg. The sediment associated with sample, CRIM-SG-02, should have further characterization, to verify the presence and extent of potential contamination of benzyl alcohol.

Polynuclear Aromatic Hydrocarbons (PAH)(EPA method SW846-8270C).
Five (5) samples were submitted for testing, with data presented in Table 5. PAHs were detected at low levels in most of the samples. Total “low molecular weight” PAH analyte levels ranged from non-detect (ND) to 113.2 ug/kg. Total “high molecular weight” PAH analyte levels ranged from ND to 485 ug/kg.

CONCLUSION

Evaluation of the sediment was conducted following procedures set forth in the U.S. Army Corps of Engineers' "Upland" Testing Manual and the "Inland" Testing Manual, developed jointly by the Corps and the U.S. Environmental Protection Agency, to assess dredged material. Guidelines used are those developed to implement the Clean Water Act (40 CFR 230), Section 404 (b)(1). These guidelines and associated screening levels are those adopted for use in the Dredge Material Evaluation Framework for the Lower Columbia River Management Area (DMEF), November 1998 (Signed by USACE, EPA, WDOE, ODEQ and WDNR).

A total of five (5) sediment samples were collected from the project site July 15, 2003 (see figure 2). All samples were submitted for physical analyses, including total volatile solids. Samples were, also, analyzed for metals (9 inorganic), total organic carbon, pesticides and polychlorinated biphenyls, phenols, phthalates, miscellaneous extractables and polynuclear aromatic hydrocarbon.

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When benzyl alcohol is released to the environment it reacts in different ways depending on the media. In dry soil, it is expected to display high mobility and readily leach through soil and volatilize into the air, however, this is not expected to be a significant process in moist soils. In water, benzyl alcohol is expected to undergo microbial degradation under aerobic and anaerobic conditions.

While the level of benzyl alcohol found in sample CRIM-SG-02 does exceed the DMEF screening level, it was detected in only one sample, which possibly picked up an isolated piece of debris containing benzyl alcohol.

It is possible to manage the material represented by CRIM-SG-02, without further characterization, by avoiding disturbance of the area or by excavating and placing the material upland, without potential exposure to the water column.

If the material, in question, is to be further characterized, to verify the presence and extent of potential contamination of benzyl alcohol. The first phase in additional characterization would likely be to take additional samples in the area and submit them for benzyl alcohol analyses, to establish a weight of evidence, as to the real threat posed to the environment by benzyl alcohol detected in sample CRIM-SG-02. If it is determined that this more intense characterization reveals benzyl alcohol is present above the DMEF screening level, then the sediment could be submitted for DMEF Tier III, bioassay analyses.

With the exception of the sediment represented by CRIM-SG-02, all other sediment represented by this sampling event are determined to be suitable for unconfined, in-water or be exposed to water after excavation, without further characterization.

REFERENCES

1. U.S. Environmental Protection Agency, Region 10; Oregon Department of Environmental Quality; Washington State Department of Natural Resources and Department of Ecology. 1998 Final. Dredge Material Evaluation Framework for the Lower Columbia River Management Area.

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Table 2. Physical Analysis & Volatile Solids

Crims Island Sampled July 15, 2003

Sample I.D.	Grain Size (mm)		Percent			
	Median	Mean	Gravel	Sand	Silt/Clay	Volatile Solids
CRIM-SG-01	0.07	0.05	0.00	57.78	42.22	2.74
CRIM-SG-02	0.05	0.07	0.26	35.87	63.87	8.78
CRIM-SG-03	0.04	0.04	0.00	24.67	75.33	4.47
CRIM-SG-04	0.07	0.06	0.00	52.67	47.33	3.83
CRIM-SG-05	0.04	0.05	0.00	32.38	67.62	3.16
Mean	0.05	0.05	0.05	40.67	59.27	4.60
Minimum	0.04	0.04	0.00	32.38	42.22	2.74
Maximum	0.07	0.07	0.26	57.78	75.33	8.78

Table 3. Inorganic Metals and TOC

Crims Island Sampled July 15, 2003

Sample I.D.	As	Cd	Cr	Cu	Pb	Hg	Ni	Ag	Zn	TOC
	mg/kg (ppm)									
CRIM-SG-01	2.28	<0.35	14.5	20.3	7.8	0.129	13.6	<0.35	76.6	5470
CRIM-SG-02	7.94	0.785 J	25.9	39.8	19.1	0.267	22.8	<0.77	161	36600
CRIM-SG-03	9.21	1.12	21.1	32	26	0.168	19.8	<0.26	172	9290
CRIM-SG-04	3.02	<0.282	16	18.1	7.27	0.061	14	<0.282	69.3	7740
CRIM-SG-05	5.81	<0.45	34.5	36.7	10.9	0.096	26.7	<0.45	95.2	11100
Mean	5.65	0.381	22.4	29.4	14.2	0.144	19.4	ND	114.8	14044
Minimum	2.28	ND	14.5	18.1	7.27	0.096	13.6	ND	69.3	
Maximum	9.21	1.12	34.5	39.8	26	0.267	26.7	ND	172	
Screening level (SL)	57	5.1	+	390	450	0.41	140	6.1	410	

J = Estimated value (reported values are above the MDL, but below the PQL).
Symbol (<) = Non-detect (ND) at the value listed (Method Detection Limit).
Symbol (+) = no screening level established.

Table 4. Pesticides, *PCBs, Phenols, Phthalates & Misc. Extractables

Crims Island Sampled July 15, 2003

Sample I.D.	Pesticides					Phenol	Phthalates		Misc. Extractables	
	ug/kg (ppb)									
	4,4'-DDD	4,4'-DDE	4,4'-DDT	Total DDT	Heptachlor	3&4 Methyl phenol	bis(2-Ethylhexyl) phthalate	Di-n-butyl phthalate	Benzyl Alcohol	Benzoic Acid
CRIM-SG-01	<1.4	<1.4	<1.4	ND	<0.69	<19	43.4 B1	16.3 JB1	<11.9	56.5 J
CRIM-SG-02	<1.4	<1.4	<1.4	ND	7.37 C1	408	<22.7	57.5 B1	**68.9**	485
CRIM-SG-03	<1.4	<1.4	<1.4	ND	<1.33	<17.5	11.4 JB1	<8.73	<10.9	<43.6
CRIM-SG-04	<1.4	<1.4	<1.4	ND	<0.68	<18	<8.99	16.9 JB1	<11.2	83.6 J
CRIM-SG-05	<1.4	<1.4	<1.4	ND	<1.92	<26.1	<13	21.6 JB1	<16.3	<65.2
Screen level (SL)				6.9	10	670	8300	5100	57	650

*No **PCBs** were detected at MDL (SL for total PCB = 130 ppb).
J = Estimated value (reported values are above the MDL, but below the PQL).
B1 = Low-level contamination was present in the method blank (reported level was < 10 times blank concentration).
Symbol (<) = Non-detect (ND) at the value listed (Method Detection Limit).

Table 5. Polynuclear Aromatic Hydrocarbons (PAHs) Low Molecular Weight Analytes
ug/kg (ppb)
Crims Island Sampled July 15, 2003

Sample I.D.	Acenaphthene	Acenaphthylene	Anthracene	Fluorene	2-Methyl naphthalene	Naphthalene	Phen-anthrene	Total Low PAHs
CRIM-SG-01	1.09 J	2.14	1.02	1.36 J	<2.37	1.69 J	2.83 J	10.1
CRIM-SG-02	110	<2.27	<2.27	<2.27	<5.67	3.22	<2.27	113.2
CRIM-SG-03	2.77	8.69	13.7	4.31	<2.18	5.63	31.4	66.5
CRIM-SG-04	<0.90	2.02	<8.99	<0.90	<2.25	2.9 J	4.78	9.7
CRIM-SG-05	<1.3	<1.3	<1.3	<1.3	<3.3	<1.3	<1.3	ND
Screen level (SL)	500	560	960	540	670	2100	1500	5200

Symbol (<) = Non-detect (ND) at the value listed (Method Detection Limit)
J = Estimated value (reported values are above the MDL, but below the PQL).

Table 5 (cont'd). Polynuclear Aromatic Hydrocarbons (PAHs) High Molecular Weight Analytes
ug/kg (ppb)
Crims Island Sampled July 15, 2003

Sample I.D.	Benzo(a)-anthracene	Benzo-fluro-anthenes	Benzo-(g,h,i)-perylene	Chrysene	Pyrene	Benzo(a)-pyrene	Indeno-(1,2,3-cd)-pyrene	Dibenz(a,h) anthracene	Fluor-anthene	Total High PAHs
CRIM-SG-01	7.51	20.7	10.9	10.3	13.3	10.7	7.7	<1.25	-	81.1
CRIM-SG-02	<2.98	<5.67	29.4	33	30.4	54.7	21.7	<2.98	-	169.2
CRIM-SG-03	49.3	88	65.6	73.9	108	72.4	47.5	16.1	-	520.8
CRIM-SG-04	<1.18	23.7	13.2	<1.8	13	16.4	9.72	<1.18	-	76.0
CRIM-SG-05	<1.71	<3.3	<1.3	<1.3	<1.3	<1.71	<1.71	<1.71	-	ND
Screen level (SL)	1300	3200	670	1400	2600	1600	600	230	1700	12000

Symbol (-) = Indicates no analyses reported.
Symbol (<) = Non-detect (ND) at the value listed (Method Detection Limit).

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Figure 1 Crims Island Vicinity Map

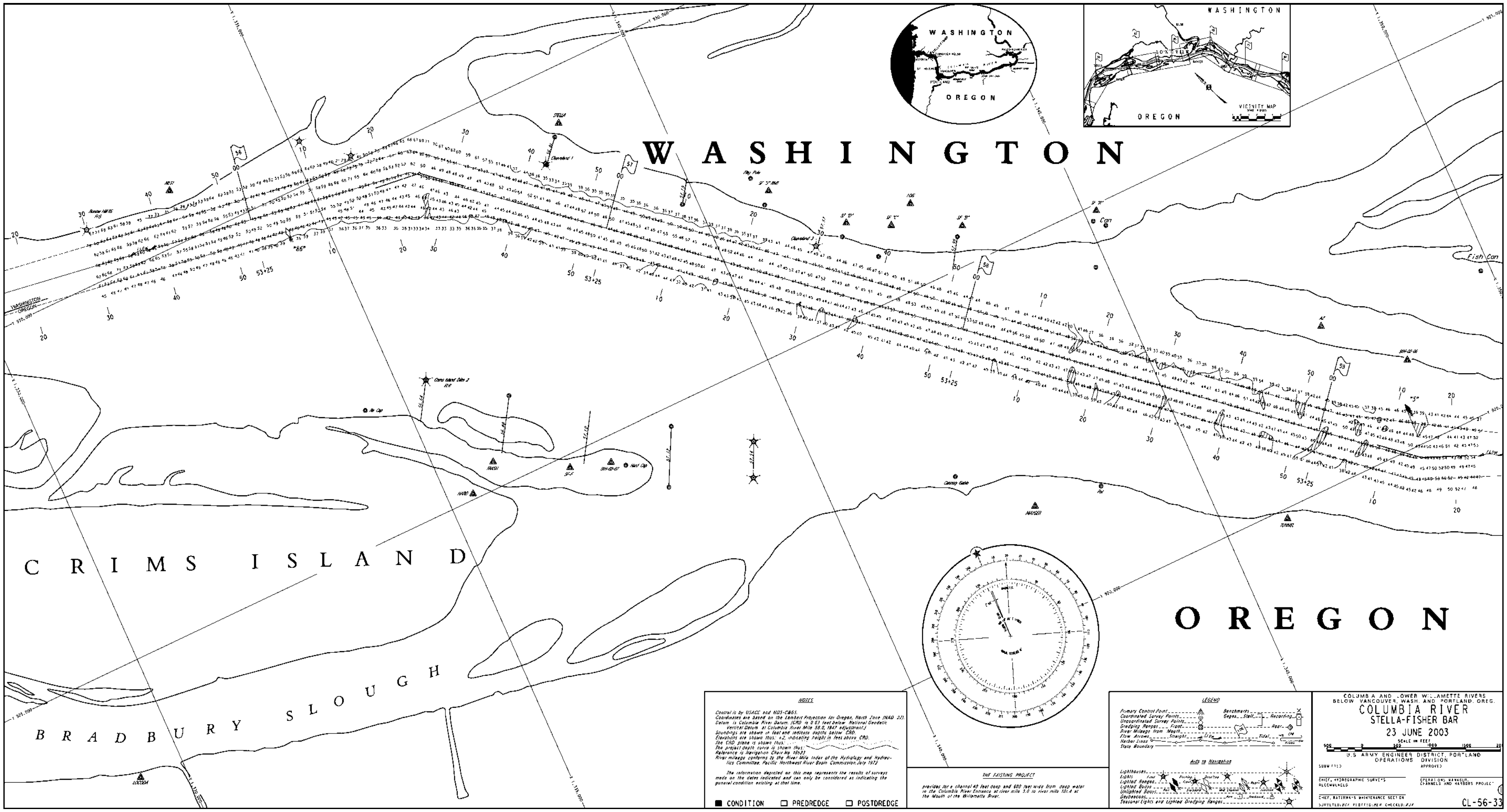

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Figure 2, Crims Island With Project Conditions & Sample Locations

Figure 3, Crims Island Sampling Location Pictures